

**U.S. ARMY CHEMICAL MATERIEL
DESTRUCTION AGENCY
(USACMDA)**

**THE ROLE OF RISK ANALYSIS
IN DIRECTING THE QUALITY ASSURANCE PROGRAM
OF THE
U.S. ARMY CHEMICAL MATERIEL DESTRUCTION AGENCY**

Presented at the:

**Twenty-Fifth DOD Explosive Safety Seminar
18-20 August, 1992
Anaheim Hilton Hotel, Anaheim, California**

**Specialized Session
Chemical Explosive Disposal**

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| Report Documentation Page | | | <i>Form Approved OMB No. 0704-0188</i> | | |
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| 1. REPORT DATE AUG 1992 | 2. REPORT TYPE | 3. DATES COVERED 00-00-1992 to 00-00-1992 | | | |
| 4. TITLE AND SUBTITLE The Role of Risk Analysis in Directing the Quality Assurance Program of the U.S. Army Chemical Materiel Destruction Agency | | 5a. CONTRACT NUMBER | | | |
| | | 5b. GRANT NUMBER | | | |
| | | 5c. PROGRAM ELEMENT NUMBER | | | |
| 6. AUTHOR(S) | | 5d. PROJECT NUMBER | | | |
| | | 5e. TASK NUMBER | | | |
| | | 5f. WORK UNIT NUMBER | | | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Chemical Materiel Destruction Agency (USACMDA),Risk and Surety Management Division,Aberdeen Proving Ground,MD,21010 | | 8. PERFORMING ORGANIZATION REPORT NUMBER | | | |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) | | 10. SPONSOR/MONITOR'S ACRONYM(S) | | | |
| | | 11. SPONSOR/MONITOR'S REPORT NUMBER(S) | | | |
| 12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited | | | | | |
| 13. SUPPLEMENTARY NOTES See also ADA260985, Volume II. Minutes of the Twenty-Fifth Explosives Safety Seminar Held in Anaheim, CA on 18-20 August 1992. | | | | | |
| 14. ABSTRACT see report | | | | | |
| 15. SUBJECT TERMS | | | | | |
| 16. SECURITY CLASSIFICATION OF: a. REPORT unclassified | | | 17. LIMITATION OF ABSTRACT Same as Report (SAR) | 18. NUMBER OF PAGES 9 | 19a. NAME OF RESPONSIBLE PERSON |
| b. ABSTRACT unclassified | c. THIS PAGE unclassified | | | | |

**THE ROLE OF RISK ANALYSES
IN DIRECTING THE QUALITY ASSURANCE PROGRAM
OF THE
U.S. ARMY CHEMICAL MATERIEL DESTRUCTION AGENCY**

Abstract

U.S. Public Law 99-145 authorizes the demilitarization of chemical agents and munitions in the custody of the United States of America and requires that demilitarization be carried out with maximum consideration for the safety of the public, the worker and protection of the environment. More recent supplemental laws further define the goals of the demilitarization effort in terms of being able to "demonstrate the quality" of demilitarization efforts. The U.S Army Chemical Materiel Destruction Agency (USACMDA) is responsible for providing centralized intensive management of the life cycle of the demilitarization and disposal of both the U.S. stockpile of lethal chemical warfare agents and munitions and disposal of those agents, munitions and facilities considered to be non stockpile. The degree of difficulty inherent to chemical demilitarization and the scope of the demilitarization program require the use of rigorous techniques that focus and enhance decision making and planning efforts. Risk analyses is one of several means by which the USACMDA enhances the decision making process.

The USACMDA employs risk analyses and its resulting expressions of probability and consequence as means of targeting quality assurance efforts in the chemical demilitarization program. Where probability and consequence combine to indicate undesirable results, the USACMDA reduces the probability of undesirable results through the implementation of a comprehensive quality assurance program. The USACMDA employs risk analyses as a basis for targeting quality assurance efforts not only where environmental protection, safety of the public and worker are concerned but also in the area of operational reliability.

Background

In 1986 U.S. Public Law 99-145 mandated the destruction of the unitary U.S. chemical weapons stockpile. Pursuant to law, the U.S. Army formed the Office of the Program Manager for Chemical Demilitarization (PM Cml Demil) to identify, initiate and manage the efforts necessary to destroy the unitary chemical weapons stockpile.

Supplemental laws and Department of Defense directives have more recently included all U.S. Department of Defense chemical warfare destruction activities (stockpile and non-stockpile) within the scope of the U.S. Army's chemical materiel destruction program. To meet this challenge, the Secretary of the Army has established the U.S Army Chemical Materiel Destruction Agency (USACMDA) which now includes the PM Cml Demil and the newly formed Office of the Program Manager for Non-Stockpile Chemical Materiel (PM NSCM).

The scope of the USACMDA mission is considerable. The destruction of the unitary chemical weapons stockpile alone involves the design, construction, systemization, operation and decommissioning of eight planned disposal plants within the continental United States and one full scale prototypical plant on Johnston Atoll. Although it is currently being studied, the scope of the non-stockpile destruction program (which includes the destruction of binary munitions, old production facilities and chemical wastes) may well be as broad as the stockpile program in terms of overall effort. The scope and degree of difficulty inherent to chemical warfare destruction activities, the active interest of the public and Federal agencies and, the requirements of Public Law require the use of rigorous techniques that focus and enhance the decision making process within USACMDA. Quality assurance and risk analysis are two techniques that play an important role in this regard.

The Paradox of the Chicken and the Egg

Figures 1 and 2 provide an overview of how the quality assurance program and risk analysis program are structured within USACMDA. It is important to note that Figure 1 (Quality Assurance Program Overview) illustrates the framework within which a technical task, such as risk analysis, is accomplished. Within USACMDA quality assurance is not the objective, it is, however, the means by which confidence in the end result is inspired, encouraged and ultimately demonstrated. At the outset of the disposal program it is essential that the quality assurance program be established before technical tasks begin. This order of precedence may appear to be a paradox often expressed by the question, "Which comes first, the chicken or the egg (i.e., technical tasks or the quality assurance program)?". It may appear illogical to put a quality assurance program into effect without knowing precisely "what" items and activities are important enough to warrant the program but, at the outset of a program it is imperative that confidence in the quality of even the first technical task be beyond reproach. Afterall, the second and third technical tasks are ordinarily based on the results produced by the first technical task. If the quality of work produced in the first

technical task is questionable, all subsequent efforts based on these results will also be questioned. In this sense, the paradox of the chicken and the egg is irrelevant. There is no chicken and there is no egg. There is, however, a need to assure the quality of technical work.

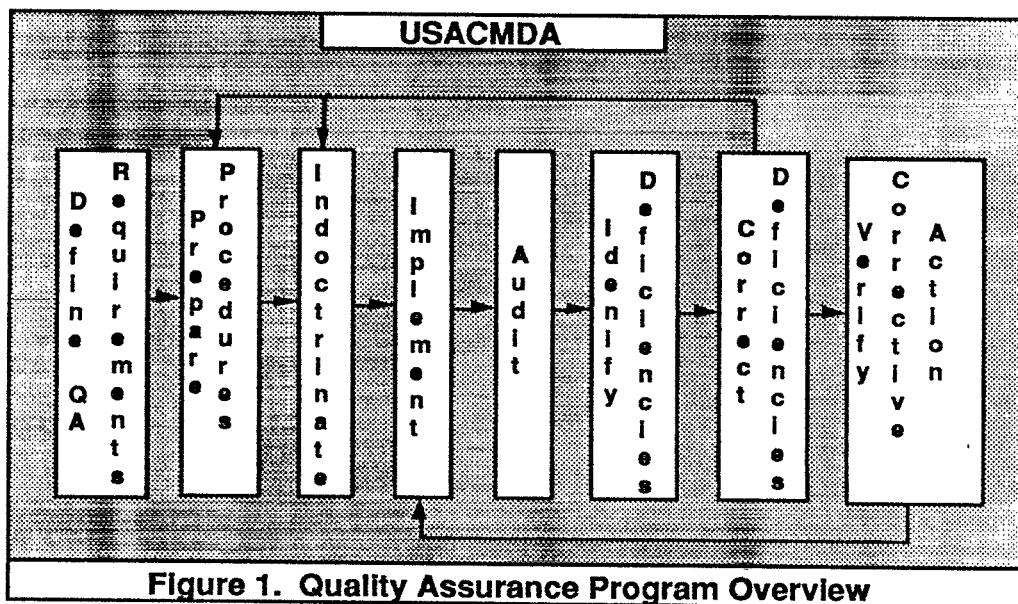


Figure 1. Quality Assurance Program Overview

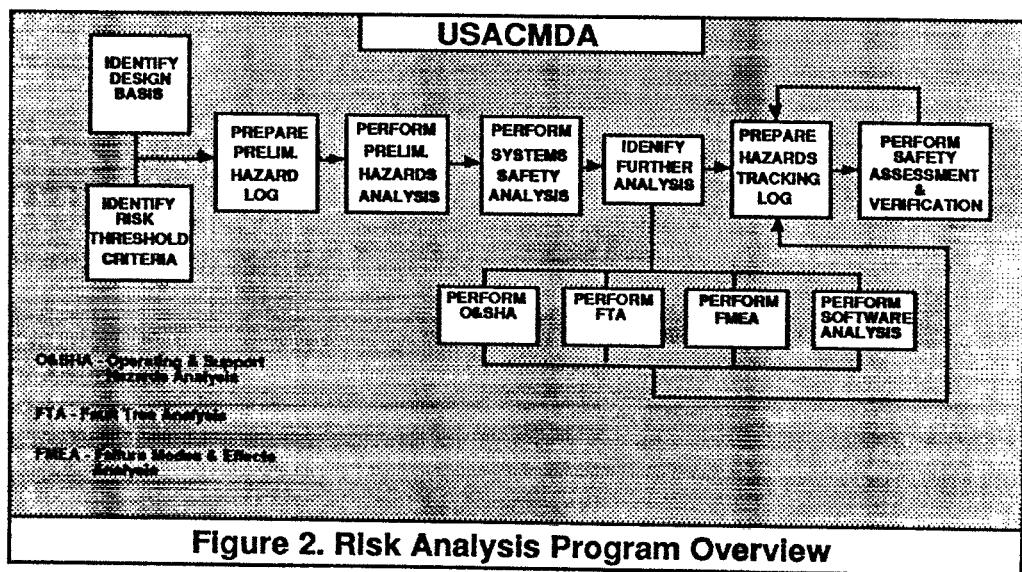
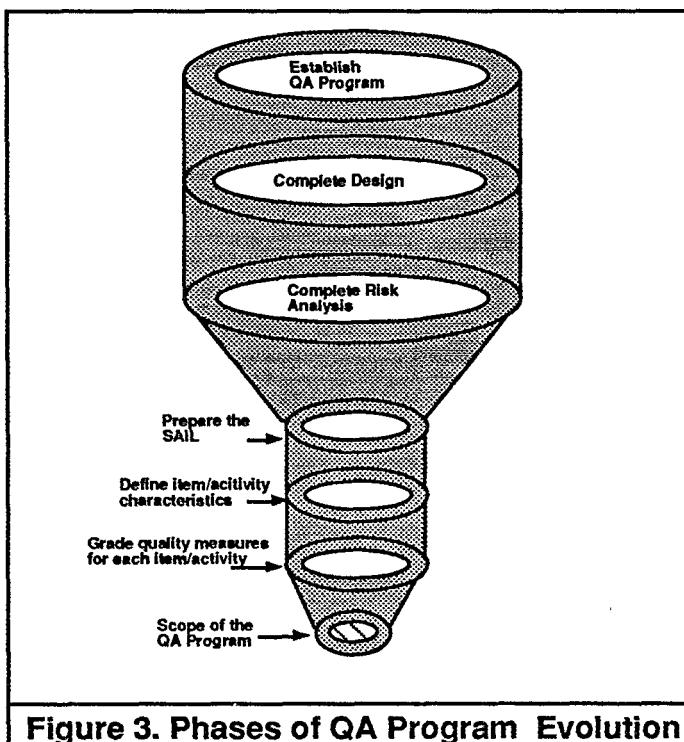


Figure 2. Risk Analysis Program Overview

This principle is at work at the outset of early USACMDA design phases such that confidence in each building block of the program is attained. As the technical work evolves to a point where sufficient information is available to separate the set of important items and activities from the simply necessary items and activities, a transition must be made from applying quality assurance to "whole" efforts (such as design and risk analysis) to focusing quality assurance efforts on specific items and activities. As in other programs of similar scope and degree of difficulty, this point of transition occurs within USACMDA following the completion of the first generation of risk analysis for a particular disposal site. Prior to having completed risk analysis the information upon which decisions regarding importance can be based is simply not available. Figure 3 illustrates the natural phases involved in the evolution of defining quality assurance measures for a USACMDA disposal site and how risk analysis plays an central role in this evolution.



The Role of Risk Analysis In Defining the Scope and Direction of the Quality Assurance Program

Once progress is made beyond the early phases of design, risk analysis becomes the principal means by which USACMDA defines the scope and direction of the quality assurance program. The application of the USACMDA quality assurance program is reserved for those items and activities whose probability and consequence of failure or malfunction exceeds safety and environmental compliance threshold criteria (see Figure 4). Once risk analysis has established the probabilities and consequences for each item and activity appearing in a given design, these results are compared to the threshold criteria and the set of items and activities that have the greatest degree of influence on the ability of USACMDA to successfully achieve the objectives outlined by Public Law begins to form. Within USACMDA, this set of items and activities are

| USACMDA |
|---|
| <p style="text-align: center;">An item or activity will be placed on the SAIL if:</p> <ol style="list-style-type: none">1. Its single failure can cause a migration of chemical agent in an amount that would exceed Permissible Exposure Limits (PEL).2. Its single failure can cause death, illness, or any manner of worker disability.3. Its single failure can cause an agent release of any kind, or a non-agent emissions release that exceeds allowable limits or conditions prescribed in regulatory permits and commitments.4. Its sole purpose is to provide redundancy for an item or activity that qualifies for inclusion on the SAIL as a result of the application of Criteria 1 through 3 above. |
| Figure 4. SAIL Threshold Criteria |

compiled into a list known as the "Significant Items and Activities List" or SAIL. Following completion of the SAIL, USACMDA characterizes each item and activity listed on the SAIL with respect to their commercial grade status, complexity, quality history, the degree of coverage by applicable national codes and standards, the need for in-process controls and, the need for special shipping and handling measures. The combination of importance (significance) and characteristics for each item and activity serves as a basis from which USACMDA selects the set of quality assurance measures that are essential to the inspiration and demonstration of confidence in their quality. The process of selecting quality assurance measures based on the combination of importance and characteristics is known as "Grading".

Sharpening the Focus of the Quality Assurance Program Through Grading

Figure 5 illustrates the topics addressed in the USACMDA Quality Assurance Program Plan (the QAPP). The QAPP is both the policy statement and the standard of expectations for the USACMDA quality assurance program. Chapter One explains the concept of the SAIL and Grading under the title Quality Program Planning and Assessment. The remaining portions of Chapter One and the remaining Chapters (Two through Thirteen) represent, in effect, a menu of quality assurance measures that are proven to enhance confidence in the quality of technical work. Not all quality assurance measures described in the QAPP are applicable to all items or activities that appear on a SAIL. Grading, or the "fitting" of quality assurance measures with

| USACMDA | |
|----------------|---|
| <u>Chapter</u> | <u>Topic</u> |
| 1 | Quality Program Planning & Assessment |
| 2 | Document Control |
| 3 | Design Control |
| 4 | Computer Software Control |
| 5 | Procurement Control |
| 6 | Inspection and Testing |
| 7 | Control of Materials, Items and Data |
| 8 | Mfg., Construction, Maintenance and Operations Control |
| 9 | Measuring and Test Equipment Control |
| 10..... | Handling, Storage and Shipping |
| 11 | Control of Nonconformances |
| 12 | Control of Records |
| 13 | Audits and Surveillance |

Figure 5. Topics Addressed by the USACMDA QAPP

each item or activity on a SAIL, is the process by which the optimum set of applicable quality assurance measures are determined according to importance and characteristics. To improve uniformity of the selection on the first grading attempt, USACMDA has prepared a logic diagram and computer code that provides a "baseline" set of quality assurance measures for each possible combination of importance and characteristics. This "baseline set" is then sent through a review process to confirm applicability and comprehensiveness. Figure 6 illustrates a portion of the computer logic for grading items that are important to safety. While grading has merit in terms of sharpening the focus of the USACMDA quality assurance program, Figure 7 illustrates that the value of grading is limited in comparison to that of risk

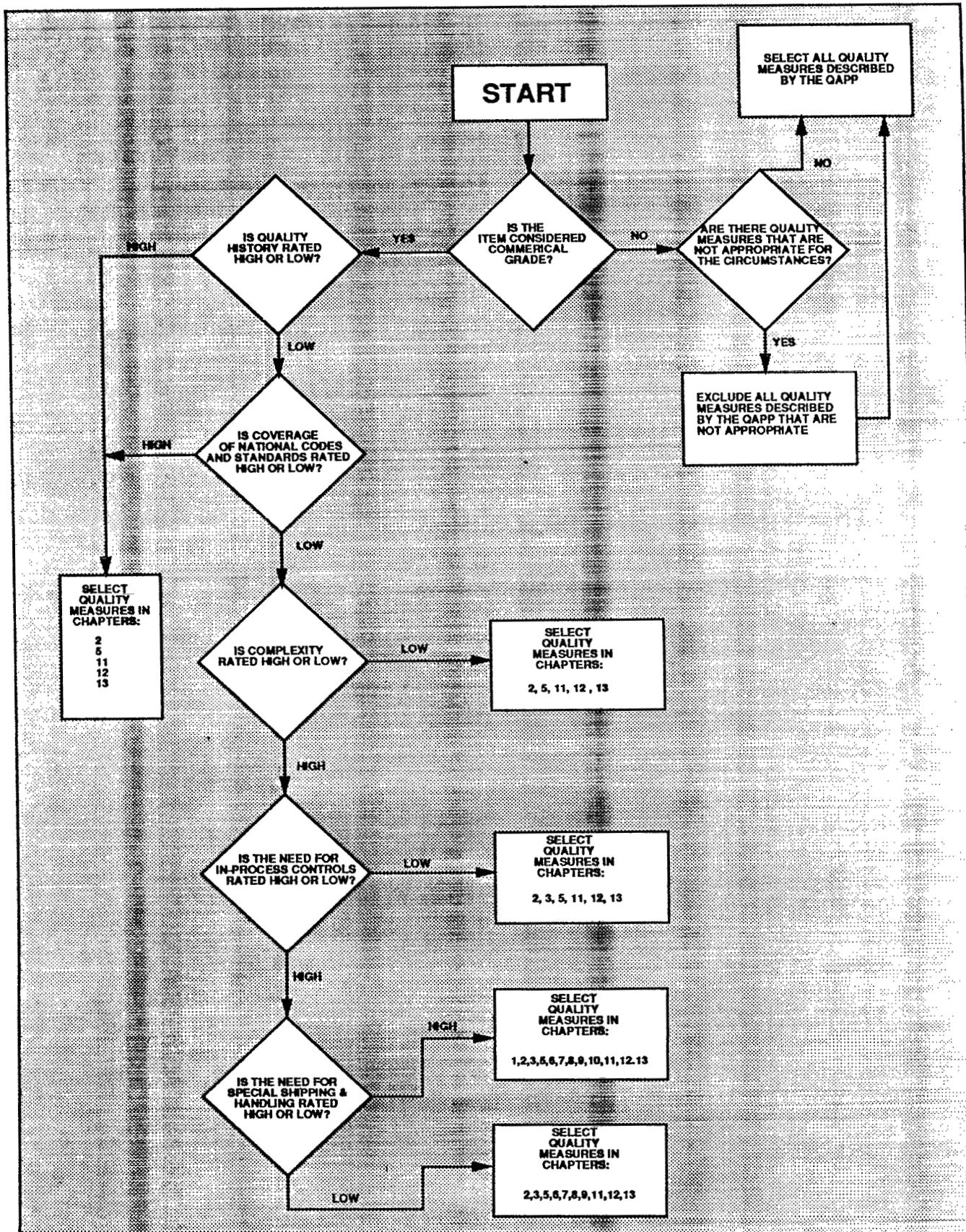
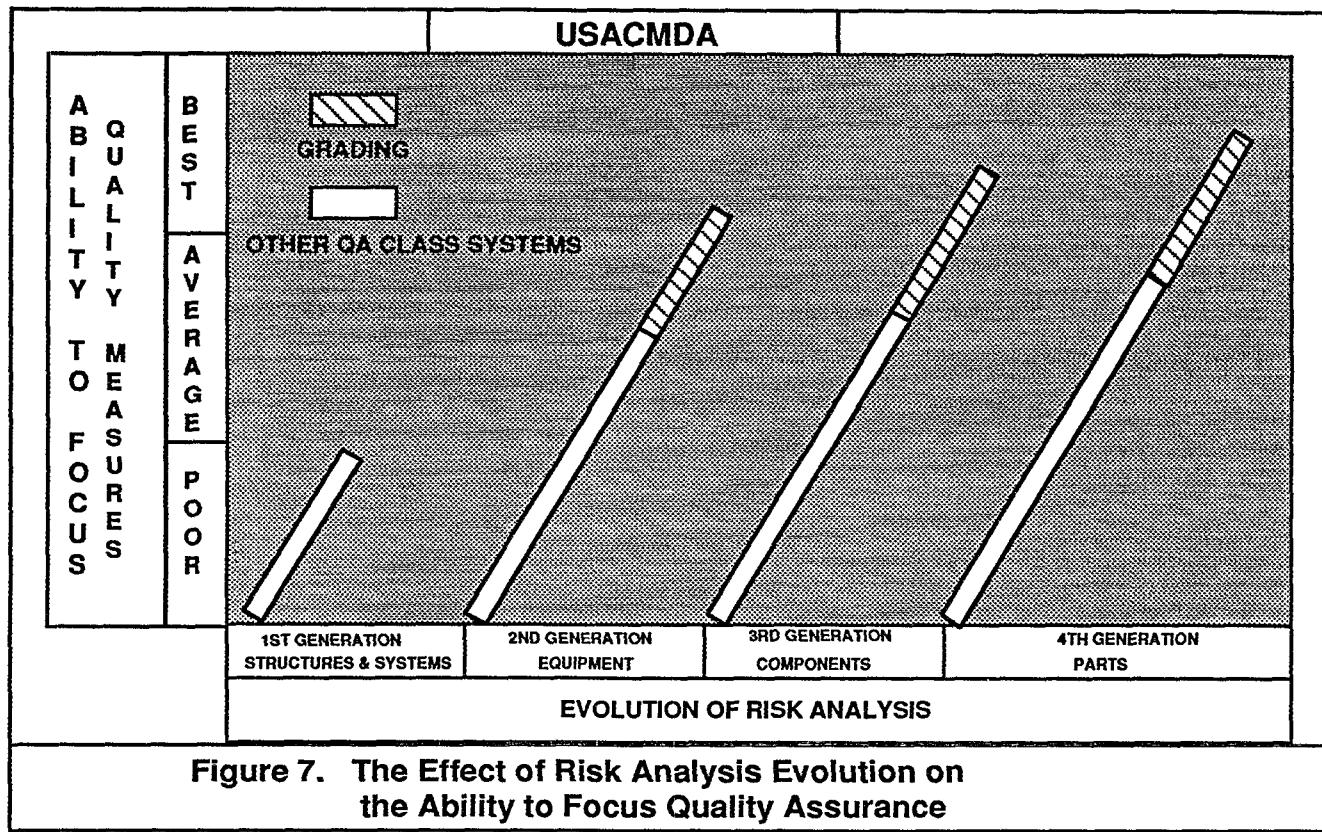


Figure 6. Computer Logic for Grading Significant Items

analysis. It should be noted in Figure 7 that an improvement in the grading process is heavily dependant on the extent, currency and comprehensiveness of risk analysis.



Summary

The scope, degree of difficulty, active public and federal interest and, the requirements of public law demand the use of rigorous techniques that focus and enhance the decision making process within USACMDA. USACMDA employs quality assurance and risk analysis in a complimentary fashion as means of enhancing confidence in the quality of the technical work. At the outset of design activities the quality assurance program is applied in "whole" fashion until sufficient information exists to permit the definition of the set of items and activities that exhibit the greatest degree of influence on the ability of USACMDA to achieve the objectives outlined by Public Law. When sufficient information is available, risk analysis serves to define the set of items and activities that are important to safety and environmental compliance. While the grading process is used by USACMDA to "fit" important items and activities with the optimum set of quality assurance measures, it is risk analysis that contributes most to the definition of the scope and direction of the quality assurance program.